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Indian Standard
SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS
PART II AMPLIFIERS

UDC 621·375 : 621·391·83

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SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS
PART II AMPLIFIERS

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Indian Standard

SPECIFICATION FOR HIGH-FIDELITY AUDIO EQUIPMENT AND SYSTEMS

PART II AMPLIFIERS

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 28 February 1983, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 Specifications for high-fidelity audio equipment and systems are being covered in a series of standards consisting of the following individual parts:

Part I	General
Part II	Amplifiers
Part III	Loudspeakers
Part IV	Record playing equipment and cartridges
Part V	Magnetic sound tape recording and reproducing equipment
Part VI	Microphone
Part VII	Headphones
Part VIII	Radio tuner equipment

0.2.1 This part (Part II) covers the performance requirements for amplifiers to be used in domestic high-fidelity audio equipment and systems.

0.2.2 The values for the characteristics 'short-circuit protection' 'transient response', 'square wave response' and 'Intermodulation distortion' in this standard have been kept under consideration as suitable information on these values was not available. The values will be added to this standard whenever suitable information is available, for the above mentioned characteristics.

0.3 While preparing this standard, assistance has been derived from the following:

IEC Doc : 29B (C. O.) 54 High-fidelity audio equipment and systems. Minimum performance requirements. Part 6 : Amplifiers, issued by the International Electrotechnical Commission (ISO).

IEC Doc : 29B (C.O.) 73 Amendment to Document 29B (Central Office) 64 : High-fidelity audio equipment and systems. Minimum performance requirements, issued by the International Electrotechnical Commission (IEC).

DIN 45500 — Blatt 6-1973 Hi-Fi techniques. Minimum requirements for amplifiers. Deutsches Institut für Normung (DIN).

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This Indian Standard (Part II) applies to linear and equalizing preamplifiers, power amplifiers and integrated amplifiers, primarily intended for high quality reproducing systems for domestic use.

2. TERMINOLOGY

2.0 For the purpose of this standard, the terms and definitions given in IS : 1885 (Part III)† and IS : 9302 (Part II)-1979‡ shall apply, in addition to the following.

2.1 Routine Tests — Tests carried out on each amplifier equipment to check the requirements which are likely to vary during production.

2.2 Acceptance Tests — Tests carried out on amplifier equipment selected from a lot for the purpose of acceptance of the lot.

2.2.1 *Lot* — All amplifier equipment of the same type, category and rating manufactured by the same factory during the same period using the same process and materials.

2.3 Type Tests — Tests carried out to prove the conformity to the requirements of this standard. These are intended to prove the general qnalities and design of a particular type of amplifier equipment.

3. MEASURING CONDITIONS

3.0 All measurements shall be made according to the general measuring conditions stated in IS : 9302 (Part I)-1979§ and the conditions for measurement specified in IS : 9302 (Part II)-1979‡.

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*Rules for rounding off numerical values (*revised*).

†Electrotechnical vocabulary: Part III Acoustics.

‡Characteristics and methods of measurements for sound system equipment: Part II Amplifiers.

§Characteristics and methods of measurements for sound system equipment: Part I General.

3.1 When during the measurements an input has to be terminated with the rated source impedance, this shall be:

22 kΩ and 250 pF in parallel for non-equalized inputs with high voltage or high impedance or both, or

2·2 kΩ for equalized low voltage inputs (magnetic pick-up inputs and the like)

NOTE — For microphone inputs the value shall be stated by the manufacturer.

3.2 When during the measurements the 'rated source emf' has to be applied, the following values of source emf shall be used instead of any other value stated by the manufacturer:

500 mV	For non-equalized inputs with high voltage or high impedance or both
5 mV	For equalized low voltage inputs (magnetic pick-up inputs and the like) at 1 000 Hz and high impedance microphone inputs
0·5 mV	For low impedance microphone inputs

4. GENERAL REQUIREMENTS

4.1 Balance Control — Pre-amplifier and integrated amplifier for stereophonic and multichannel reproduction shall be fitted with user balance control(s) or equivalent arrangement (for example, separated gain controls for each channel) giving at least 8 dB gain variation in each channel.

4.2 ' Loudness ' Control — Amplifiers provided with a ' loudness ' control (giving bass boost and in some instances treble boost at high attenuations effected by the gain control) shall also be provided with a user control to nullify the boosting effect(s).

NOTE — This may be effected either by a separate switch or by the adjustment of tone controls.

5. MARKING OF CONTROLS

5.1 Provision of **6** of IS : 9302 (Part II)-1980* shall apply in addition to the following.

5.1.1 The range of adjustment shall be marked either at the control or in the users instructions, within which the manufacturer stipulates that a position will be found such that for the balance control, equality of channel gain occurs, and for the tone control the requirements of effective frequency range specified are met. This range shall be not more than 10 percent of the total travel of the control.

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*Characteristics and methods of measurements for sound system equipment: Part II Amplifier.

5.2 The amplifiers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. TESTS

6.1 Classification of Tests

6.1.1 *Type Tests* — Unless otherwise specified the manufacturers shall submit samples for type tests. The sequence of type tests shall be as given in Table 1.

6.1.1.1 *Number of samples* — One sample shall be selected out of a lot of 100 pieces.

6.1.1.2 *Criteria of approval* — The sample subjected to type tests shall meet the requirements as specified. In case of failure in any test(s) the testing authority shall call for twice the number of samples for retest(s). No failure is permitted on the retest(s).

6.1.2 *Acceptance Tests* — The samples for acceptance tests shall be subjected to the following tests and shall meet the requirements specified.

a) Effective frequency range,

b) Gain alignment,

c) Total harmonic distortion,

d) Rated output power,

e) Over-all cross-talk attenuation (between channels), and

f) Wide band signal-to-noise ratio.

6.1.2.1 *Sampling and criteria for approval* — The sampling procedure and the criteria for conformity shall be in accordance with Appendix A.

6.1.3 *Routine Tests* — Each amplifier shall be subjected to the following tests and shall conform to the requirements specified:

a) Rated output power, and

b) Wide band signal-to-noise ratio.

6.2 Characteristics and Requirements

6.2.1 The characteristics, their methods of measurements and the requirements to be met are given in Table 1.

TABLE 1 TEST SCHEDULE

(*Clausés* 6.1.1 *and* 6.2.1)

Sl No.	Characteristic	Method of Measurement [Cl Ref of IS : 9302 (Part II)-1979*]	Requirement
(1)	(2)	(3)	(4)
1.	Effective frequency range	8.20	Frequency response curve: 40 Hz to 16 000 Hz Permissible deviations from the required frequency response, referred to the response at 1 kHz Non-equalized inputs ± 1·5 dB Equalized inputs ±2·0 dB
2.	Gain alignment	8.43	Within a frequency range of 250 Hz to 6 300 Hz the gain difference between channels shall be ⩽ 4dB
3.	Total harmonic distortion	8.22.1	The total harmonic distortion at rated output power for amplifiers and at rated voltage for pre-amplifiers shall not exceed the following values over the frequency range 40 Hz to 16 000 Hz: Pre-amplifier 0·7 percent Power amplifier 0·7 percent Integrated amplifier 1·0 percent For power and integrated amplifiers the output power at the above specified value of distortion is allowed to fall by 3 dB (relative to the rated value) for frequencies between 40 Hz and 63 Hz and between 12 500 Hz and 16 000 Hz. The specified distortion value shall not be exceeded at any output level above −26 dB referred to rated output-power or voltage

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*Characteristics and methods of measurements for sound system equipment: Part II Amplifiers.

(*Continued*)

TABLE 1 TEST SCHEDULE — *Contd*

SL No.	CHARACTERISTIC	METHOD OF MEASUREMENT [CL REF OF IS : 9302 (PART II)-1979*]	REQUIREMENT
(1)	(2)	(3)	(3)
4.	Rated output power	8.9	At least 10 W per channel, specified for the total harmonic distortion in Sl No. 3. Multi-channel amplifiers to be rated with all channels operating simultaneously at rated output power NOTE 1 — The amplifier shall be able to deliver the rated output power at rated distortion during a period of at least 10 min with all channels operating simultaneously at rated output power and at an ambient temperature between 15°C and 35°C NOTE 2 — To achieve a correct combination of amplifier output power and loudspeaker sensitivity the combination of amplifier and loudspeaker should be capable of reproducing a sound pressure level of at least 96 dB ref. 2×10^{-5}. pa at a distance of 1 m in free field conditions
5.	Overload source emf	8.12 8.42	Non-equalized inputs 2 V Equalized inputs 30 mV, 1 000 Hz
6.	Over-all cross-talk attenuation (between channels)	NOTE — The input of the channel to be measured shall be terminated according to **3.1**	Between 250 Hz and 10 000 Hz $\geqslant$30 dB, but with a minimum of 40 dB at 1 000 Hz For stereo-sets figures apply from maximum setting of gain control to —40 dB

7.	Over-all cross-talk attenuation (between inputs)	8.42 NOTE — As note of Sl No. 6	Between 250 Hz and 10 000 Hz : $\geqslant$40 dB, but with a minimum of 50 dB at 1 000 Hz
8.	Wide band signal-to-noise-ratio	8.26.1 and 8.31 This is calculated as follows: *Pre-amplifier* $20 \log \frac{U_x}{U'_2}$ (dB) where U_x = reference output voltage, and U'_2 = noise output voltage The reference output voltage U_x shall be the output voltage given by the rated source emf at the particular volume control setting *Power and integrated amplifier* $10 \log \frac{P_x}{P'_2}$ (dB) where P_x = reference output power, and P'_2 = noise output power The reference output power P_x shall be the rated output power NOTE 1 — The wide band filter used for the noise measurement shall be as specified NOTE 2 — The noise level is expressed with reference to the rated output power, since loudspeakers designed for use with high power amplifiers are normally of lower sensitivity than those designed for use with low power amplifiers NOTE 3 — All appropriate controls are to be set to such a position, that the requirements of Sl No. 1 are met	Pre-amplifier : $\geqslant$55 dB The requirement shall be met at all settings of the volume control, from that giving the rated output voltage with the relevant rated source emf in **3.2** to that giving an attenuation of 23 dB Power amplifier (without volume control) $\geqslant$70 dB Integrated amplifier (power amplifier with integrated pre-amplifier): a) $\geqslant$55 dB This requirement shall be met at that setting of the volume control which gives the rated output power; the amplifier being fed with the relevant rated source emf given in **3.2** b) $\geqslant$ 68 dB This requirement shall be met at that setting of the volume control which gives an output power of 23 dB below the rated output power; the amplifier being fed with the relevant rated source emf given in **3.2**

(*Continued*)

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[*] Characteristics and methods of measurements for sound system equipment: Part II Amplifiers.

TABLE 1 TEST SCHEDULE — *Contd*

Sl No.	Characteristic	Method of Measurement [Cl Ref of IS : 9302 (Part II)-1979*]	Requirement
(1)	(2)	(3)	(4)
9.	Weighted signal-to-noise ratio	8.26.2 and 8.31 This is calculated as follows: *Pre-amplifier* $20 \log \frac{U_x}{U'_2}$ (dB) where U_x = reference output voltage, and U'_2 = noise output voltage The reference output voltage U_x shall be the output voltage given by the rated source emf at the particular volume control setting *Power and integrated amplifier* $10 \log \frac{P_x}{P'_2}$ (dB) where P_x = reference output power, and P'_2 = noise output power The reference output power P_x shall be the rated output power Note 1 — The A-weighting filter used for the noise measurement is the curve 'A' specified in IS : 9779-1981† Note 2 — The noise level is expressed with reference to the rated output power, since loudspeakers designed for use with high power amplifiers are normally of lower sensitivity than those designed for use with low power amplifiers	Pre-amplifier $\geqslant 65$ dB The requirement shall be met at all settings of the volume control from that giving the rated output voltage with the relevant rated source emf in **3.3**, down to that giving an attenuation of 23 dB Power amplifier (without volume control) $\geqslant 75$ dB *Integrated amplifier* (Power amplifier with integrated pre-amplifier) : a) $\geqslant 55$ dB This requirement shall be met at that setting of the volume control which gives the rated output power; the amplifier being fed with the relevant rated source emf given in **3.2** b) $\geqslant 73$ dB This requirement shall be met at that setting of the volume control which gives an output power of 23 dB below the rated output power; the amplifier being fed with the relevant rated source emf given in **3.2**

		NOTE 3 — All appropriate controls are to be set to such a position, that the requirements of Sl No. 1 are met	
10.	Load impedance	2.5	Up to load impedance that is 20 percent less than the nominal load impedance the amplifier shall be operatable
11.	Climatic sequence tests		At the end of the climatic sequence tests, the amplifire shall meet the following performance requirements: a) Effective frequency range shall be as specified in Sl No. 1 b) Gain alignment shall be as specified in Sl No. 2 c) Total harmonic distortion shall be as specified in Sl No. 3 d) Rated output power shall be as specified in Sl No. 4 e) Overall cross-talk attenuation shall be specified in Sl No. 6 f) Wide band signal-to-noise ratio shall be as specified in Sl No. 8
	a) Dry heat test	In accordance with IS: 9000 (Part III/Sec 5)-1977‡ the test shall be carried out at a temperature of 40°C and for a duration of 96 h	
	b) Damp heat test (first cycle)	In accordance with IS : 9000 (Part V/Sec 1)-1981‡	
	c) Cold	In accordance with IS : 9000 (Part II/Sec 4)-1977‡ the test shall be carried out at a temperature of 10°C and for a duration of 16 h	
	d) Damp heat (second cycle)	In accordance with IS : 9000 (Part V/Sec 1)-1981‡ followed by a recovery period of 24 h	
12.	Drop test	In accordance with IS: 9000 (Part VII/Sec 3)-1979‡ the number of drops being six and height of drop being 25 mm	There shall be no mechanical damage and no change in the rated output power and wide band signal-to-noise ratio

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*Characteristics and methods of measurements for sound system equipment: Part II Amplifiers.

†Specification for sound level meters.

‡Basic environmental testing procedures for electronic and electrical items:

Part III Dry heat test, Section 5 Dry heat test for heat dissipating items with gradual change of temperature.

Part V Damp heat (cyclic) test, Section 1 16 + 8 h cycle.

Part II Cold test, Section 4 Cold test for heat dissipating items with gradual change of temperature.

Part VII Impact test, Section 3 Drop and topple.

APPENDIX A

(*Clause* 6.1.2.1)

SAMPLING AND CRITERIA FOR CONFORMITY

A-1. LOT

A-1.1 All the amplifier equipment of the same model and type having the same design and manufactured by the same technique under eventually similar conditions of production shall constitute a lot.

A-1.1.1 Samples shall be taken and tested to ascertain the conformity of each lot for acceptance tests.

A-2. SCALE OF SAMPLING

A-2.1 Amplifier equipment shall be taken at random according to Table 2 (*see* IS : 4905-1968*).

TABLE 2 SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

LOT SIZE (N) (1)	FIRST SAMPLE (N_1) (2)	SECOND SAMPLE (N_2) (3)	COMBINED SAMPLE ($N_1 + N_2$) (4)	ACCEPTANCE NUMBER (5)	REJECTION NUMBER (6)
Up to 150	5	5	10	0	2
151 to 300	8	8	16	0	2
301 and above	13	13	26	0	2

A-3. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

A-3.1 Amplifier equipments shall be drawn from each lot according to col 1 and 2 of Table 2 and subjected to the acceptance tests specified in **6.1.2.** If an equipment fails in any one of the acceptance tests, it shall be called as defective. If the number of defectives found in the first sample (*see* col 3) is zero (*see* col 5), the lot shall be considered as conforming to the acceptance tests. If the number of defectives is equal to or greater than two (*see* col 6), the lot shall be considered as not conforming to the acceptance tests.

A-3.1.1 If the number of defectives is equal to one, further sample of equipment shall be taken as specified in col 3 of Table 2 and tested for all the acceptance tests. If the number of defectives in the combined sample (*see* col 4), is less than two (*see* col 6), the lot shall be considered as conforming to the acceptance tests otherwise rejected.

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*Methods for random sampling.